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ABSTRACT

The growth of local alliances (partnerships of business, industry, labor, professional associations, educators, and other concerned groups) is evidence of a widespread public concern for improving the quality of science and technology education. This document defines the concept of local alliances and discusses aspects of the founding and operation of an alliance. Topics include the composition, needs, goals, priorities, funding, programs and projects, evaluation, communications and publicity of these organizations. Appendices include: (1) conference participants; (2) resources from other organizations; (3) consultants; (4) a list of the members of the Triangle Coalition; (5) excerpts from "Building Alliances for Science Education"; and (6) a questionnaire for local alliance information. (CW)

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How to Form and Operate a Local Alliance

A handbook for local action to improve science and technology education

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Triangle Coalition for Science and Technology Education

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How to Form and Operate a Local Alliance

A handbook for local action to improve science and technology education

Triangle Coalition for Science and Technology Education

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Introduction

It's happening now. More than 40 groups have formed over the past three or four years to help teachers redesign education in science and technology. Additional local groups are starting all the time, with their members representing business and industry, science and engineering, and local school systems. Starting from these three points of reference, the "triangle" groups are making an impact on education.

The growth of local alliances is evidence of a widespread public concern for improving the quality of science and technology education. Their very existence in widely scattered areas provides a hope that such diverse groups can work together effectively toward a common goal. A current list of local alliances can be obtained from the Alliance Clearinghouse maintained at the Triangle Coalition office.

Let us know about your progress in setting up and running your alliance. We will include the information you send us in the Triangle Coalition Clearinghouse, and will share accounts of your experiences with other local alliances via the newsletter and bulletin board.

The strength of these alliances is that they are *local*. This is important. Global efforts, such as the national curriculum projects of 20 years ago, were limited in their effectiveness because they were national programs imposed from *outside* on the local school systems.

These projects did not always address local needs, nor did local teachers always have a voice in decisions about implementation. Community groups were generally not included in the decision-making process.

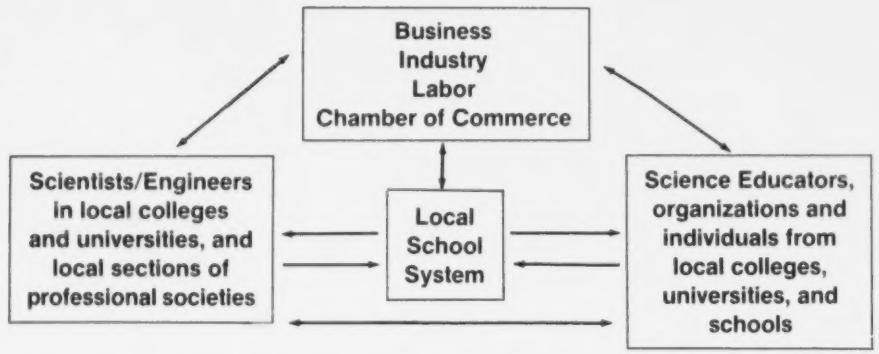
In contrast, the present local alliances start *inside* the community. They center around the local school system, and concern for the specific needs of teachers is paramount. These alliances involve community groups. All of their members are affected by and concerned with the quality of science and technology education offered to children in the local elementary and secondary schools. Diagram 1 illustrates this.

How does a concerned group start and operate a local alliance? How do they help teachers involve students in learning science and technology? The suggestions in this handbook come from various sources, including existing local alliances, a working group that met in July 1985 (Appendix A), and handbooks published by several groups (Appendix B).

In addition to this handbook, the Triangle Coalition can help you in many ways:

- A bimonthly newsletter, *Alliance Network News*, contains information on current activities of local alliances. To get on the mailing list, write the Triangle Coalition.
- A clearinghouse of local alliances; the coalition staff is gathering data on existing groups and adding new ones as they are formed.
- An inventory of national programs which provide direct assistance to

Diagram 1. Typical coalition interactions.


Business
Industry
Labor
Chamber of Commerce
Scientists/Engineers in local colleges and universities, and local sections of professional societies
Local School System
Science Educators, organizations and individuals from local colleges, universities, and schools

teachers—summer internships, in-service training, equipment loan programs, "expert" volunteers, etc. A first printing of this inventory should be available in Fall 1986.

- Several experienced local alliance directors are willing to serve as consultants to groups starting new alliances. Appendix C provides a list of these consultants. The Triangle Coalition staff can give you additional names that have been added to the list since this handbook was first published.

PLEASE USE THE FORM IN APPENDIX F TO PROVIDE INFORMATION ABOUT YOUR ALLIANCE.

Background

Concern over the state of education, and particularly over education in science and technology, achieved national prominence in "A Nation at Risk," published in the spring of 1983. That report contained both an eloquent expression of the challenge and thoughtful directions for change. Later "Action for Excellence," a report of the Education Commission of the States Task Force on Education for Economic Growth, echoed the challenge for action.

THE PROBLEM

We have even squandered the gains in student achievement made in the wake of the Sputnik challenge.

Moreover, we have dismantled essential support systems which helped make those gains possible. We have, in effect, been committing an act of unthinking, unilateral educational disarmament.—*A Nation at Risk*, page 5.

The small percentage of students in the United States who are planning to enter scientific and technical professions has remained roughly constant in recent years, and so have their achievement levels. But most students today end their encounters with science and mathematics early in high school. This declining exposure to technical subjects is a serious problem which threatens to become more serious as American workers face increasing technological demands—*Action for Excellence*, page 23.

WHAT NEEDS TO BE DONE

Our final word, perhaps better characterized as a plea, is that all segments of our population give attention to the implementation of our recommendations. Our present plight did not appear overnight, and the responsibility for our current situation is widespread. Reform of our educational system will take time and unwavering commitment. It will require equally widespread, energetic, and dedicated action . . . . Help should come from students themselves; from parents, teachers, and school boards; from colleges and universities; from local, state, and federal officials; from teachers' and administrators' organizations; from industrial and labor councils; and from other groups with interest in and responsibility for educational reform.—*A Nation at Risk*, page 36.

It is time—not to leave education to the educators, job training to businesses, and unemployment worries to labor unions—but to bring all of these people together to design programs that are realistic in an educational atmosphere and effective in an economic atmosphere.—*Action for Excellence*, page 23.

The National Science Board's Commission on Precollege Education in Mathematics, Science, and Technology had a more narrow focus than the other two, but its report, "Educating Americans for the 21st Century," described problems and suggested remedial steps that were similar.

THE PROBLEM

Alarming numbers of young Americans are ill-equipped to work in, contribute to, profit from, and enjoy our increasingly technological society. Far too many emerge from the nation's elementary and secondary schools with an inadequate grounding in mathematics, science, and technology. As a result, they lack sufficient knowledge to acquire the training, skills, and understanding that are needed today and will be even more critically needed in the 21st century. This must not continue—improved preparation of all students in the fields of mathematics, science, and technology is essential to the maintenance and development of our nation's economic strength, to its military security, to its continued commitment to the democratic ideal of an informed and participating citizenry, and to fulfilling personal lives for its people.—*Educating Americans for the 21st Century*, page 1.

RECOMMENDATIONS FOR ACTION

Due to the variety and diversity of American communities, it is neither desirable nor possible to be specific as to the appropriate mechanism for inducing change at the local level. However, the Commission strongly recommends that local school boards foster partnerships between the school board, school administrators, local officials, business and industry, labor leaders, and parents in order to facilitate constructive change. They should encourage business and other institutions not primarily involved in education to become active participants and lend fiscal, political, and other support to the local education system. They should help to further plans for improving educational offerings that stress mathematics, science, and technology, rigorous curricula, and high standards of student and teacher commitment and performance. They should encourage parental involvement in all these efforts. One mechanism which might, in certain situations, be appropriate is the establishment of local councils on mathematics, science, and technology education.—*Educating Americans for the 21st Century*, page 11.

The Triangle Coalition for Science and Technology Education provides a national forum for discussing issues in science and technology education and a framework for mobilizing the resources and support of various groups with a serious stake in science education. As the membership list shows (Appendix D), this includes organizations from business, industry, labor, science, engineering, medicine, and formal and informal education.

The inclusion of business and industry in all steps from problem diagnosis to prescription and treatment makes this quite different from the efforts to improve science education in the 1960's.

Education's importance to business and the value of business involvement in education is the dual theme of a recent report, "Investing in Our Children," published by the Subcommittee on Business and the Schools of the Committee for Economic Development (CED). The CED report, which calls for a "bottom up" effort to improve education, includes the following rationale and guidelines.

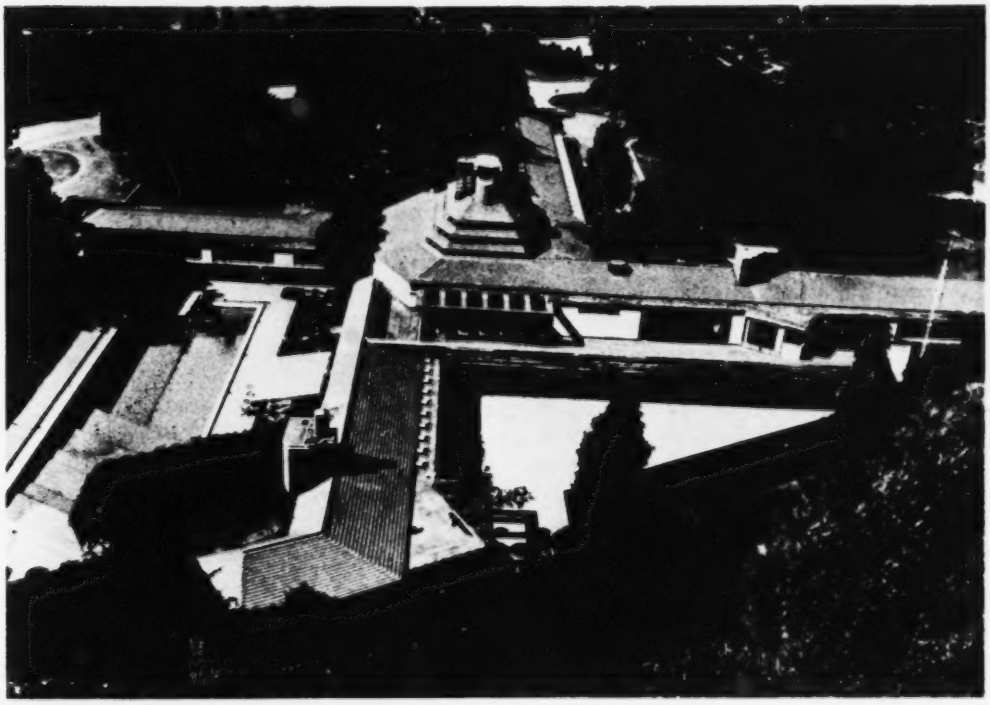
WHAT BUSINESS CAN DO

We urge businesses to examine the potential for improving education by working with existing organizations in the community and to take the lead in establishing new organizations if needed.

Many models exist for successful business involvement in skills and curriculum development, and interested corporations should look closely at what has been shown to work when planning their involvement.—*Investing in Our Children, page 12.*

These recipes for action emphasize both broad-based approaches and local involvement. National communication and coordination can increase the intensity and efficiency of public commitment. However, the educational changes needed to make students full citizens of the new scientific-technological age will come about in the end because of local awareness and local initiative.

As a top-priority task, therefore, the Triangle Coalition is working to identify and expand the network of broad-based local alliances that will marshall local resources to improve science and technology education.



The Wingspread Conference Center was built as a home for the Johnson family (of the Johnson Wax Company) by Frank Lloyd Wright. It is one of his famous "prairie houses." Henry Halsted, vice president of the Johnson Foundation, which cosponsored the Conference, provided a quotation from this master architect that could well serve as a slogan for the local alliance movement.

From the ground up makes sense for building.
Beware of from the top down.

The alliances are building from the ground up. We hope that this handbook will add specificity and encouragement to construct a foundation for the years of effort needed to open the doors to the world of science and technology for all students.

The Conference on Local Alliances July 1985

Emphasis on local action was a key recommendation of the Triangle Conference on Science and Technology Education held at Airlie House, Virginia, in August 1984. The Triangle Coalition, formed at the recommendation of this conference, undertook as its major task the organization of a summer 1985 conference on local alliances. Held at the Wingspread Conference Center, Racine, Wisconsin, on July 18, 19, and 20, the conference brought together representatives of 30 existing or fledgling local groups and 15 professional organizations with strong local structures (see Appendix A). The conferees were asked two questions:

> What can the Triangle Coalition do to assist currently-active local alliances?
>
> What can the Triangle Coalition do to encourage the formation of additional local alliances?

Among other recommendations, the conference participants specifically requested that the Triangle Coalition develop:

- A brochure to promote the idea of local alliances.
- A "how-to" handbook to guide and to assist alliance coordinators.
- A clearinghouse/directory service for the exchange of information.
- A newsletter and, when practical, an electronic bulletin board for communication among alliances and between the Triangle Coalition and local groups.

This handbook is the Triangle Coalition's response to the second request. In it we give examples of diverse local alliances; we outline some of the steps in getting underway and suggest possible funding sources and strategies, including an overview of the kind of help the Triangle Coalition can provide. Finally, we describe the kinds of programs and activities that can be (and have been) set up by local alliances.

This is a "How To . . . " handbook. We assume that its readers are already convinced that science and technology education needs drastic revitalization. The reports quoted at the beginning are among many that suggest what should be done. We see local alliances as a significant force in producing these changes.

Local alliances will serve as two-way channels along which information can flow between centers of national and local activity. They will provide a fulcrum for community leverage to help schools and teachers move in new directions.

Alliances

What is a local alliance?

A local alliance for improving education in science and technology is a partnership of business, industry, labor, professional associations, educators, and other concerned groups. Some alliances may be concerned about other areas of education, but this handbook considers only education in science and technology.

The top priority is providing help for school systems, and particularly for teachers and students, in a variety of ways. This help ranges from activities, such as local scientists and engineers serving as teacher or student mentors, to policy matters, such as working to pass bond issues for the support of public education.

Alliances take many forms. Some are local, focused around a city or a school system. Others are statewide or regional.

An alliance may grow from a small nucleus such as the education committee of a local Chamber of Commerce. It may develop from a college or university center for science and mathematics education, around which individuals and related groups can be mobilized. Or it may stem from other sources, as in the examples below.

The Memphis, Tennessee, "Adopt-A-School" program was started by the Memphis City Schools. It involves local businesses and industries—some quite small, others branches of national industries—in working with individual schools to help improve educational opportunities of students. Some Adopt-A-School programs are directed specifically toward science and technology education, but others, like the one in Memphis, are more general.

The BET (Business and Education Together) program of the California Chamber of Commerce is a statewide project. Like the Memphis program, it is broader than science and technology. Concerned with precollege education in general, it involves local Chambers of Commerce in initiating programs to improve education.

The Colorado Alliance for Science is a statewide project focused on the problem of improving education in all of the sciences and related technologies. A similar organization, the Minnesota Alliance for Science, was started by the University of Minnesota. More detailed information about the Colorado and Minnesota alliances is in Appendix E.

Who should be in an alliance?

Any organization that is or should be concerned about the quality of science and technology education belongs in a local alliance. For example:

From the private sector:

- the local Chamber of Commerce
- local trade associations
- local businesses
- local industries, including branches of national industries. Consider especially branches of national industries that are members of the Triangle Coalition, since these industries already support the concept of local alliances.
- local chapters of industrial unions

From the science and technology sector:

- local chapters of national scientific and engineering societies such as the American Chemical Society, American Physical Society, American Medical Association, Sigma Xi (the

national science honorary society), American Society of Mechanical Engineers, Institute of Electrical and Electronic Engineers
- Government laboratories (federal, state, and local)

From the education sector:
- science and engineering departments of local colleges and universities (Note that most science and engineering faculty members are members of local sections of their professional societies. In beginning to establish a local alliance, it would be helpful to make contact with them.)
- local sections of science teaching organizations such as the National Science Teachers Association, American Association of Physics Teachers, National Association of Biology Teachers, National Earth Science Teachers Association, National Association of Geology Teachers
- local and regional school administrators and principals associations

Individuals from the education sector:
- school superintendents and other administrators
- school principals
- science supervisors
- teachers

It is important to involve groups in the public sector of the community, including policy makers in local and state governments.

Other groups and organizations that might be interested in participating are:
- state and local academies of science
- science and technology museums
- science centers
- religious and social organizations
- media (radio, TV, and print)
- local sections of organizations of retired persons, such as the American Association of Retired Persons

It may seem strange to include religious and social organizations in the list of groups who might be interested in helping to improve science and technology education, but the Memphis "Adopt-A-School" program illustrates some possibilities. A bus from the First Baptist-Beale Church takes elementary school children on field trips; Alpha Kappa Alpha Sorority awards savings bonds to 4th, 5th, and 6th grade students who show significant improvement in their grade-point averages; volunteers from Idlewild Presbyterian Church serve as tutors in the schools; and St. John's Methodist Church supplies software for a computer awareness program for students at Bruce Elementary School.

Any organization that is or should be concerned about the quality of science and technology education belongs in a local alliance.

Another group you might consider is an academic alliance. The University of Pennsylvania sponsors local academic alliances of teachers in the same discipline at all grade levels—elementary school through university. Other colleges and universities may have similar programs. The Pennsylvania program is intended to overcome the intellectual isolation that many teachers experience. For further information, write or call Dr. Claire Gaudiani, Academic Alliances CGS, 210 Logan Hall/CN, University of Pennsylvania 19104, (215) 898-3113.

Starting an Alliance

Who initiates it?

Anyone who is actively concerned with improving science and technology education can initiate a local alliance. This might be a person from a school system—the superintendent or a science supervisor, for example. He or she might be the Chief Executive Officer of a local industry or of the local branch of a national industry, an administrator or professor from a college or university, the director or education officer of a science museum, or an officer of the local section of a national science or engineering society.

The initiator's first step in forming a local alliance is to bring together interested individuals. They can discuss the perceived problems in science and technology education in a series of planning meetings and devise tentative plans for attacking the problems. The next step we recommend is to set up a steering committee, appoint a coordinator, and provide an adequate staff. **Arrange for funding and establish goals and priorities after carefully assessing the local needs for improving science and technology education.** With a clear concept of the problems that need to be solved, the alliance can start operating—developing programs and projects to begin solving the problems. That is the third step. It includes the process of obtaining the funds necessary to support the programs. The next step—evaluating the effectiveness of the projects and programs—is extremely important and easy to overlook. Planning for the evaluation process should begin while the programs themselves are being established.

You may want to consult with others who have already had experience in operating local alliances as you are starting to establish your own. A list of individuals who are experienced and who have agreed to serve as consultants to new alliances is in Appendix C. Other names may be obtained from the Triangle Coalition headquarters in Washington, D.C.

Steering committee

The function of the steering committee is to set policy; assess current science and technology programs in the schools and establish needs; develop programs and projects aimed at improving science and technology education; plan evaluation procedures and review results; arrange public relations activities; approve the budget; and assist with fund-raising.

The steering committee should be large enough to include representatives of all the types of organizations and the diverse constituencies included in the alliance. Size will vary from place to place and will depend on the size and demography of the community. Membership should probably be proportional to the numbers of the various types of organizations—industry, science and technology, education, and so on—belonging to the local alliance.

Above all, the steering committee must be an *active* entity. It should not be a debating society or a group that sits around a table occasionally to share thoughts on educational problems and their possible solutions. The function of the steering committee is to see that something gets done. Members of the

committee should have a sense of "ownership" of the alliance. Agendas for meetings of the steering committee should be carefully planned, with action as the expected outcome.

One example of the steps in forming a local alliance was published in the 1985 NSTA Yearbook.[1] An exerpt from the paper describing the steps is in Appendix E.

IMPORTANT: Before forming a steering committee, make contact with as many potentially interested organizations as possible. It is easier to get organizations and people involved from the start than to try to recruit them later.

Russell Hobbie, coorganizer of the Minnesota Alliance for Science, calls this "establishing a firm political base" and says, "That kind of homework is absolutely essential." He points out further that it took four months to contact the 67 leaders from the private sector, universities, school systems, and public policy makers who were the founders of the Minnesota Alliance for Science.

Coordinator/director and staff

All of this implies that someone or a few persons are identifying organizations and talking with key people in them to try to sell them the idea of a local alliance. Certainly at the very beginning such a person or persons will be volunteer, or perhaps appointed by a dean of a college or university or by the CEO of a local industry.

However, before long one person—a coordinator or executive director—must be responsible for the day-to-day operations of the alliance. Depending on the size and magnitude of the alliance operation and the financial situation, the coordinator/executive director could range from a part-time volunteer to a full-time salaried person. A salaried person with a strong commitment to developing an alliance is preferable to an unsalaried volunteer, either part-time or full-time.

The director will need clerical support. The steering committee should make sure that the alliance has a responsible, effective director with adequate clerical assistance and the funds to run a professional office.

---

[1]Colorado and Minnesota Alliances for Science. Manert Kennedy and Von Valetta. 1985 NSTA *Yearbook: Science/Technology/Society.*

Needs, Goals, and Priorities

Assessment of needs

A local alliance should start with assessment of community needs for education in science and technology. Concerned individuals may have divergent views on what should be taught, how it should be taught, what should be included, and what should be left out in science and technology courses. Therefore, the first and most important step the alliance should take in planning its programs is to determine the local consensus (including teacher opinions) on what should be done to improve the community's science and technology education.

Some of the needs of the local education community will be obvious, others will be brought to light as the assessment process is developed, and still others may not be evident at all. Involving businesses and industries in local alliances will bring new views on "needs." Businesses and industries will be interested in whether the local education system will provide them with new employees skilled not only in science and technology, but in related proficiencies such as communication.

"No program can succeed unless teachers support it. Programs are unlikely to succeed unless school supervisors, school boards, and other educational administrators support them."—Emmett Maddry, Professor of Physics, Randolph-Macon College, and participant in the Wingspread Conference on Local Alliances, July 1985

An obvious and urgent deficiency in most communities is the inadequate science and technology background of many teachers assigned to these areas. Those teachers who *are* adequately prepared often lack opportunities for refreshing and upgrading their technical knowledge and acquiring new teaching techniques through in-service science and technology courses, summer science education programs, opportunities to work in industrial or government labs, and so on.

Elementary school teachers have a special problem. Most of them have rather sketchy backgrounds in science and none in technology. As a result, they range from being uninterested to being terrified when asked to teach science. Even without formal assessment, it is fair to say that any effective alliance program to improve the science and technology backgrounds of elementary school teachers, and above all to build their confidence in teaching science, will be worth doing.

How do you assess teachers' needs? Ask them. Meetings of steering committee members with teachers can help to find out what the teachers think would be useful to them in upgrading their knowledge of science and technology and their teaching methods in these areas. Meetings with teachers should be arranged through the appropriate administrators—school principals and science supervisors in the school administration office.

Such meetings can also reveal other felt needs. Do secondary school teachers have adequate supplies and equipment to teach up-to-date laboratory courses? Do elementary teachers have "hands-on" science materials, or are they limited to teaching science by textbook or trade book? Are there appropriate and sufficient opportunities for students to go on field trips? If there are, where do they go? And what evidence is there that the field trips contribute significantly to their science and technology learning and understand-

ing? Do teachers use community resources and facilities such as science museums to help them teach?

Since most teachers these days are members of unions—the American Federation of Teachers or the National Education Association—they may be wary of outsiders trying to find out what their needs are in improving their teaching. Hence, try to involve the unions in any assessment efforts. Both the NEA and the AFT are members of the Triangle Coalition. A questionnaire developed by (or in cooperation with) local union chapters might be useful in assessing teachers' views about their needs.

The ultimate test of any educational program is the ability of students to perform after they have completed it. Are they sufficiently well educated in science and technology that they are accepted by leading colleges and universities? Can they qualify for technical jobs in business and industry? How do their test scores compare with national norms? School records will provide answers to these questions.

What are student attitudes toward science and technology? Do they like the subjects, despise them, or are they indifferent? Look for qualitative answers in meetings with students from all interest areas, not just those specializing in science and technology. A major thrust of precollege science and technology education should be to develop scientifically and technologically literate citizens. What evidence is there that this is happening in your local schools? Meetings with students will help supply an answer.

Enrichment needs may not be evident at all to teachers and students. Can the local alliance provide or encourage educational experiences that the schools haven't considered? Here is a role for science museums and centers, colleges and universities, industrial and government laboratories, and state and local academies of science, especially through junior academy of science programs.

Each local alliance should look for other problem areas that need to be assessed. One question you might ask is, "Are secondary school biology teachers in our schools free to teach modern evolutionary theory, or are they inhibited by pressure groups outside the schools?" In some parts of the country this is a problem. If it is in yours, what can and should your local alliance do to counteract the interference?

". . . it was clear that our focus would have to be at the local level . . . [we] developed a bottom-up approach to education reform. The best education reform is homegrown. . . Lofty statements from blue ribbon commissions do not really deal with the interaction between the teacher and the student in the classroom."—Sol Hurwitz, Senior Vice President, Committee for Economic Development. As quoted in *PEForum*, Sept. 1985.

Establishing goals and priorities

After developing a list of educational needs, the steering committee's next task is to set goals and decide on the order for seeking solutions. Remember that it is more useful and effective to do one thing well than to do a host of things sketchily. In establishing goals and priorities, consider carefully how long a project or program will take if it is done properly; what the costs are; who will actually *do* (not just advise on or make policy about) the things that are expected to be done; and how you will know whether or not a program or project is successful.

All who are going to be involved in the programs and projects that will change the educational process and attempt to reach the established goals must have a sense of "ownership" of the effort. Teachers need to feel that they are part of any program or project that affects them. Industries and scientific societies need to be active and effective participants in all educational projects they decide should be carried out.

Funding and Other Support

Financial support of a local alliance should be of two types: "core support" for day-to-day operations and support for programs and projects. Both are important, and they may have different sources of funds. The core support, which should come from the member organizations, provides the basic support of the local office. This support group includes all local alliance members—business/industry/labor; science and engineering individuals and organizations; and education, including local boards of education, colleges, and universities.

Program support will be tied closely to the goals and priorities of the group. If the alliance is an Adopt-a-School type, where local businesses and industries are providing assistance directly to schools, it is possible that all of the funds will be supplied by the local businesses and industries.

If the activities include programs like teacher workshops, curriculum development, and summer work programs, you may need other sources of financial assistance. Foundations, both national (National Science Foundation, Ford, Carnegie, Kettering, and so on) and local, of which there are many, are one possible source of funds. Local and state governments are another.

A task force of the Triangle Coalition has prepared a brochure[2] for industries explaining the intent of minigrants and their possible effect on the quality of teaching. It emphasizes the value of providing minigrant funds to local alliances.

[2] *Partnerships in Science: Mini-Grant Programs.* Brochure available from the Triangle Coalition for Science and Technology Education, 1742 Connecticut Ave. N.W., Washington, DC 20009.

Recommended procedures

For an excellent discussion of funding sources and strategies, see *Industry-Education-Labor Collaboration—An Action Guide for Collaborative Councils,* Chapter 6, titled "The Funding Game." It was prepared in 1981 by the National Institute for Work and Learning (NIWL), under contract with the U.S. Department of Education Office of Vocational and Adult Education.

The report gives the following advice (page 42) to councils ("alliances" in our context):

> **Before a council starts beating the bushes for grants, contracts, and contributions . . . it should be able to answer two important questions:**
>
> - **Why are we seeking funding? What kind of organization do we want our council to be?**
> - **What do we plan to do with this specific money? How will it fit with our longer-range plan for financial support?**
>
> **Answers to these questions will help steer a council toward the most appropriate funding sources. It's best to be choosy. Rarely is money simply given away; there are almost always strings attached. Deciding which funding sources will be most useful in helping a council achieve its goals and objectives can be confusing.**

The NIWL Guide further discusses the need to "know thyself," stating that without self-knowledge, a council (alliance) may find itself tied to a funding source that does nothing to enhance the council's status and significance to its members and its community. It suggests asking these questions:

- Is the philosophy of the funding source . . . similar to the council's?
- Is the council looking for core sup-

port . . . for support of on-going projects, or for special projects?

- . . . how does the opportunity for funding fit with council and community needs?

And words of warning. "Funding that provokes jealousy and turfdom, splinters rather than unites the community. Competition for funds with other local organizations should be avoided."

Another danger the NIWL Guide points out is that sometimes a "funder begins 'using' the council to accomplish its own goals at the expense of the council's goals."

Sources of funds

Support for the basic operation of an alliance should, in most cases, be obtained locally. Ask local businesses and industries for contributions, perhaps in the form of annual dues, for day-to-day operations. School districts may have funds to contribute, and state departments of education, local colleges, and universities are also likely sources of financial support. Many universities have science, mathematics, and technology education centers. Funds supporting these centers could help to support a local alliance.

Special projects may be supported by local contributions, but also consider other funding agencies such as local and national foundations. Federal funds from agencies such as the Department of Education and the National Science Foundation may be available on a competitive basis to support certain kinds of projects. State departments of education have access to federal funds for some educational programs. Approach them to determine what sorts of projects they are willing to consider for financial support.

Nonfinancial support

Many local organizations and individuals may assist in the programs and projects of the alliance without compensation. For example, many retired scientists and engineers are willing and eager to volunteer as tutors for students and as mentors for teachers. Industrial and government laboratories are sometimes willing to donate science and engineering equipment that is no longer useful for testing and research, but is perfectly adequate for educational purposes.

Industries, colleges and universities, and government laboratories may be willing to organize visits and field trips for student groups. Some retired scientists and engineers might organize field trips to enable students to observe and study phenomena in the local environment—geology, botany, zoology, industrial chemistry, engineering, and similar topics.

"No matter how appealing a specific program or project may seem, nothing is as powerful an incentive as an abiding and impelling belief in the mission of your institution. Donors wish to give to something that makes a difference, a program that has the potential for creating a significant change for the good."—Margaret Shantz, Fund-raising Consultant—Browning Associates. As quoted in *PEForum*, Vol. 1, No. 1, September 1985. The Public Education Fund, Pittsburgh

Help from the Triangle Coalition

The Triangle Coalition will help local alliances identify funding sources. It can supply local contacts of member businesses and industries. Through *Alliance Network News*, local alliances can keep up-to-date on specific funding programs (for example, from the National Science Foundation) that may be of interest to them.

Local sections of professional societies and industries that are members of the Triangle Coalition may be helpful to you in organizing or supporting a local alliance. Current members of the Triangle Coalition are listed in Appendix D.

The Triangle Coalition has established a clearinghouse on local alliance information, including sources of funds. This information can be made available on request.

Alliance Programs and Projects

There is a broad spectrum of programs and projects[3] that local alliances may undertake to assist local schools and school systems. Projects might include single focused workshops; specifically targeted in-service activities of any length; or any sort of one-time event. Programs would include systematically organized activities aimed at reaching larger goals, such as those related to computer literacy, attainment of particular levels of science and technology proficiency, and targets for teacher preparation.

Recommendations from Wingspread

Participants in the Wingspread Conference suggested a number of aspects of problems in science and technology education that a local alliance might consider in deciding on projects and programs.

Teacher isolation is a major problem in most school systems. Teachers in general feel isolated. They need to have regular opportunities to discuss their difficulties and their successes in teaching science and technology. This is particularly a problem for teachers in the elementary grades, although secondary-level biology, chemistry, earth science, and physics teachers can also benefit from regular meetings. A program of periodic in-service workshops (perhaps monthly or bimonthly) would bring teachers together to consider ways of improving their knowledge of science and technology, as well as to share effective teaching techniques.

Teachers in grades K-6 often feel anxious and inadequate teaching science and technology. Most K-6 teachers have limited preservice education in the area—most have had some general science and biology, but nothing more than that. A program to increase these teachers' knowledge of science and technology would be useful. Activities such as in-service workshops to reduce their anxiety when teaching science and technology would be even more important. In-service programs could be arranged in which peer teachers who are successful at teaching science could share their experiences and suggest teaching techniques.

To make teachers, both elementary and secondary, aware of applications of science and technology to business and industry, have local companies arrange a well-planned program to demonstrate how they use science/technology. This might involve a series of lecture demonstrations by industry representatives and visits to local industrial plants.

A major issue in contemporary education is the general ignorance of high school graduates about basic processes and concepts in the physical world. This is largely because students avoid taking elective science courses. This, in turn, stems from the fact that most students are "turned off" from science by the time they reach upper secondary school, probably due mostly

[3]It may be helpful to distinguish between programs and projects in the following way. A *program* is a broad effort to bring about a change in science and technology education; for example, to provide in-service education for elementary and secondary school teachers. A *project* is a specific activity; for example, it might be an astronomy course for teachers given by the local planetarium.

to inadequate science experiences in elementary school.

This is a large problem. Solutions to it are not obvious and will not be easy, but a local alliance working closely with the administration and teachers of the local school system may want to attack it. The many facets of the problem include improving the qualifications of teachers; improving the curriculum and the methods of teaching in the elementary grades to help keep students "turned on" to science; changing the focus of science courses in the secondary school so that they aim at providing science knowledge and understanding for the general student, not just for students heading for science in college; and enriching the opportunities of students to learn about and understand science and its applications by museum programs, well-planned visits to industries, government laboratories, geological and biological field trips, and so on.

There is an increasing interest in providing minigrants to teachers. Minigrants may be awarded on a competitive basis, or they may be simply awarded to teachers after evaluation of a request. Minigrants are intended to enhance the effectiveness of teachers' educational endeavors.

Checklist of projects and programs

The following list of educational programs is suggestive, but by no means inclusive, of the sorts of activities a local alliance might engage in:

- *workshops* to improve curriculum content in specific disciplines such as chemistry, physics, computer science, energy, biology; and to improve development of student skills in creativity, inquisitiveness, and analytical problem solving;
- *site visits* to industry, hospital, and university laboratories;
- *classroom presentations* by science practitioners from industry and health professions;
- *summer internships* in industry for in-service credit, supplemented by Saturday seminars during the preceding semester;
- *information dissemination* through print and audiovisual material and through the use of electronic bulletin boards;
- *attendance at conferences* of professional scientific organizations at no or low cost, often with specially designed teacher workshops for appropriate grade levels;

". . . a Minigrant Program for K-12 teachers of science, mathematics, and computer science . . . (makes) grants available in amounts up to five hundred dollars.

The grant money is to be used to develop curriculum-related activities such as laboratory experiments, learning centers, research and/or resource materials, and so on."—Gertrude M. Clarke, Executive Coordinator, New Jersey Business/Science Education Consortium, Stevens Institute of Technology, Castle Point Station, Hoboken, NJ 07030.

- *access to a resource library* of books and equipment that could be borrowed by various schools, including computer-assisted instructional activities and simulations;
- *linkages to industry* for exchange of personnel, for donations or use of equipment and other resources, for access to the work environment, and for financial support; and
- *awards for excellence.*

Case studies

Colorado Alliance for Science (Report of the Second Annual Meeting, Feb. 8, 1985, page 7). "The National Bureau of Standards has a CARE Program that began with Boulder Valley Schools in 1978 and has expanded throughout a several-state area, including remote regions, via videotape. First, a contract is set up between the Bureau and the school. Needs are identified and matched with resources. Assistance is offered in the areas of career shadowing, classroom presentations, loan of equipment, tours, and individ-

ual volunteer work/study situations. All efforts are tailored to reinforce the school's existing curriculum."

The Atlanta Partnership of Business & Education, Inc. (Fourth Anniversary Report, page 16). "The Rich's Academy is a 'street academy' operated by the Atlanta Public School System in the downtown Rich's Department Store. The student body is composed totally of former high school dropouts or 'threshold' cases who transferred from a regular high school instead of withdrawing completely . . . Each of the current 103 students . . . is matched with a 'motivator' employee who serves as an advocate."

See "Partnerships in Science," available from the Triangle Coalition.

Although this "partnership" is not only concerned with improving education in science and technology, it is a model that local alliances might wish to consider in setting up programs and projects for improving science and technology education.

The Philadelphia High School Academies. The Philadelphia Urban Coalition mounted a different attack on the high school dropout problem. The coalition "became the city's chief catalyst for bringing business and schools together in an effort to reduce both unemployment and the enormous secondary school dropout rate [in the late 1960's]."

In 1969 the school district piloted the Electrical Academy at Thomas Edison High School. The academy quickly proved its ability to attract, motivate, and retain students. Currently there are three high school science and technology academies in Philadelphia—the Academy of Applied Electrical Science, Inc.; the Academy of Applied Automotive and Mechanical Science; and the Health Care Academy. These three joined in 1983 with two similar business academies to form the Philadelphia High School Academy Association, Inc. The program in 1983 served 653 students and had an operating budget of $750,000. Over 100 local businesses and industries participate financially or in-kind in the program.

Three publications have been prepared to assist in implementing the Philadelphia program: *Orientation Guide, Planning Issues Guide,* and *Teacher Training Guide.*

For more information contact Dr. Marion Holmes, Executive Director, Career and Vocational Education, School District of Philadelphia, John F. Kennedy Square, 734 Schuylkill Ave., Philadelphia, PA 19146; (215) 875-3800; or Mr. Hendrik Koning, Director, High School Academies, c/o Philadelphia Electric Co., 2301 Market St., Philadelphia, PA 19101; (215) 841-5568.

The California Roundtable and The California Round Table on Educational Opportunity—Math Science Task Force *(The Challenge of Improving Mathematics and Science Education in California,* May 1985, page 9). "The Corporate Volunteer Program brings industry and business people into the classroom in Oakland City Schools . . . the program augments classroom teachers in various ways such as a research chemist spending an hour or two a week assisting a chemistry teacher during lab sessions . . . The Contra Costa County Partnership in Mathematics, Science and Technology is a collaborative effort of the County School District, the Industry Education Council, local schools and businesses, and other organizations. It will offer 1985 summer teacher internships in industry for highly qualified mathematics and science teachers, and will provide teacher in-service fellowships for underqualified mathematics teachers."

Memphis City Schools—Adopt-a-School (Annual Report, April 1984, page 14). Buckman Laboratories, Inc., arranges monthly tours for students from Cypress Junior High to "Provide an opportunity for the students to

invade the adult world of business. Computers, sophisticated laboratory equipment, super-speedy processors, . . . a working greenhouse—these are places to visit, to witness demonstrations, to see role models at work."

(page 16) Catherine's Stout Shoppe holds a rocketry project for sixth graders at Delano Elementary School. "After six weeks of study and construction, the Launch Day was a great experience for every child at Delano."

(page 36) First Tennessee Bank provides an internship in the data processing department of the bank for a graduate of Craigmont High.

(page 125) Tennessee Environmental Health Association arranged a health fair for K-3 classes at Carnes Elementary. ". . . nutritionists, nurses, and a representative from LeBonheur Children's Hospital provided exhibits and activities."

(page 132) The U.S. Army Corps of Engineers plans seminars and tours to acquaint students at East High with activities relating to flood control and navigation, automatic data processing, and the photography, hydraulics, and soil testing laboratories of the Corps.

Texas Alliance for Minorities in Engineering (1984 Annual Report, page 6). "Juniors and seniors in Austin area high schools received 40 summer scholarships from that city's local alliance. The scholarships entitled the recipients to study at Austin Community College . . . The Austin Alliance helped 60 of its members find employment for the summer . . . "

Pittsburgh Regional Center For Science Teachers (PRCST LASER, Volume 1, Issue 5). "Elementary teachers—sixty strong—gathered at the Carnegie Museum of Natural History for a day-long workshop . . . Exploring into an elementary science program, teachers spent the morning at the Buhl Science Center."

New Jersey Business/Industry/Science Education Consortium (Gertrude M. Clarke, Executive Coordinator, Stevens Institute of Technology, Castle Point, Hoboken, New Jersey 07030). "The Summer Industrial Internship Program is a summer employment program designed to give junior and senior high school teachers of science, mathematics, and computer science an opportunity to work in an industrial setting." The teacher interns spend eight weeks assisting on industrial projects, and each is paid $5000. A sample reaction: ". . . this program has provided me with an opportunity to upgrade my skills and knowledge of chemistry and instrumentation . . . an intellectually challenging experience . . . I look forward to sharing my new knowledge with students and other teachers."

Project to Increase Mastery in Mathematics and Science (PIMMS). PIMMS is a Connecticut project supported by Wesleyan University, the Connecticut State Department of Education, the Connecticut Academy of Science and Engineering, 11 industries, and 4 philanthropic foundations.

The project issues periodic bulletins listing in-service workshops for teachers; conducts an intensive summer workshop in math and computers for teachers of grades 4-8; puts on an annual two-day junior-senior high school meeting; and "operates a fellowship program [for teachers grades 5-12] that furnishes a selected group of math and science teachers in Connecticut an opportunity to extend their command of subject matter and to engage in field-work, providing consultative assistance on request to teachers, schools, and school systems."—Robert A. Rosenbaum, University Professor of Math and the Sciences, Wesleyan University.

Evaluation of Programs and Projects

Evaluation of programs and projects is important for two reasons. First, it will tell you whether a program or project has indeed achieved the goals that were set for it. Second, it will enable the steering committee to identify strong and weak points and to apply midcourse corrections where necessary to make the program or project more effective.

The steering committee should decide when and how often to evaluate a program or project. A short-term project can be evaluated when it is finished. A long-term program might be evaluated semi-annually or annually.

When should evaluation start?

Develop your plans for evaluation of projects and programs and for design of evaluation instruments as you develop the educational materials themselves. In other words, evaluation should begin at the beginning. It should not be an afterthought.

The simultaneous design of project materials and evaluation ideas and instruments can work as a two-way street. Thinking about how to evaluate a proposed activity can help to mold the activity, and considering the proposed activity can suggest ways of evaluating it. The symbiotic relationship is useful and important.

Evaluation techniques

Both qualitative and quantitative evaluation can be useful. Use quantitative examinations for projects that can be evaluated appropriately at the end with a multiple-choice or other written test. A course in astronomy for teachers is an example of this type. On the other hand, a student paper presentation session at a State Junior Academy of Science meeting should be evaluated qualitatively. Were the papers thoughtful or trivial? Did they reflect original student work?

Who should do the evaluation?

In his lecture to the participants in the Wingspread conference on local alliances, Robert Finnell stated that science and technology education is so important that it should not be left to science and technology educators alone. This was not to denigrate teachers, but rather to underscore the importance of all segments of the community working together to help improve science and technology education.

Similarly, evaluation is too important to be left to professional evaluators alone. If many community groups are involved in the process, it will emphasize the importance of evaluation for any project or program.

Professional evaluators should certainly be working closely with the alliance staff, advising and producing instruments to evaluate such things as student achievement and student and teacher attitudes toward science and technology.

Other members of the community can engage in less formal evaluation—interviewing teachers and students to get impressions of their reactions to the alliance's programs and projects; obtaining the views of the concerned businesses, industries, and scientific organizations on the efficacy of the programs and projects; and so on.

Communication and Publicity

Local outlets and contacts

Publicity about the activities of a local alliance is important. Not only will it keep the community informed of the programs and projects the alliance has launched, but it also may serve to attract other local groups to join the alliance and participate in the activities.

Each alliance should determine the most effective modes of arranging local publicity. Newspapers, radio, and television are obvious avenues to follow, with other means used as much as possible. For example, you might try a teacher recognition luncheon arranged by the local Chamber of Commerce, a program of community activities to celebrate National Science Week, or presentations of alliance activities to local groups such as PTA. There will be many opportunities to "spread the word." Be alert to find them and innovative in using them.

National publicity

The Triangle Coalition can help promote national publicity for the activities of local alliances. In part this will be done by extending the network of alliances and sharing information about the network members through *Alliance Network News.*

While national publicity may not be immediately useful to an individual alliance, it can help new local alliances to get started. It may also help alliances to obtain funding from national foundations.

We will work continually to help the members of the Triangle Coalition—the nationwide industries, scientific societies, and science education organizations—to use the coalition's publications to inform their branches and members of their possible roles in local alliances.

Although everyone hopes that every program and project will be successful and that none of them will fail—some will. Don't hesitate to terminate a program or project if evaluation shows it is a bust! Use evaluation results to help with long-range planning. If a program is highly successful, should the alliance consider continuing it beyond the originally planned period?

Summary

With the examples of local projects and programs in this handbook, and with the suggestions from various sources on how to go about building and operating a local alliance, we hope that you will make rapid progress in establishing a local alliance in your area.

As you proceed, keep in mind that the staff of the Triangle Coalition for Science and Technology Education is eager to help you. If we can't answer your questions or fill your needs, we have an ample pool of experienced local alliance people we can call on.

And don't forget to keep us informed of your progress. Information about your successes, and even your failures, can be invaluable to other groups engaged in enterprises like yours.

Some newspapers have a weekly education supplement. If your local newspaper has one (or if you can induce it to start one), this is an opportunity for you to foster a coordinated effort between your local alliance and journalists to encourage improvements in science and technology education. Newspaper features on classroom and out-of-school programs and projects to improve science and technology education will encourage teachers to point their students toward the newspaper—a spin-off benefit to the newspaper—as well as inform the local populace of the school programs that are supported and encouraged by the local alliance.

Communications among alliances

The Triangle Coalition will provide two means for local alliances to communicate with each other. One is the bimonthly newsletter, *Alliance Network News,* containing information about what local alliances are doing and descriptions of projects and programs that they want to share with each other. In addition, the newsletter will inform local alliances of what the Triangle Coalition is doing and request help in carrying out national projects.

A second communication device in the works is an electronic bulletin board. Local alliances could leave messages about their activities to be shared immediately by other individuals and alliances with access to the bulletin board via computer and modem. An alliance could use the board to raise questions and seek comments from other alliances. This arrangement would enable members to share information more quickly and in greater detail than is possible in the newsletter. The Triangle Coalition will investigate the practicality of establishing such a bulletin board in 1987.

Appendix A

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Appendix B

How-To Handbooks

- *A Sure Bet . . . Business and Education Together.* 1985. California Chamber of Commerce, 1027 Tenth Street, P.O. Box 1736, Sacramento, CA 95808.
- *Strategies for Increasing Involvement of Research Scientists in Implementation of Innovative Science Education Programs, Phase II.* 1984. Federation of American Societies for Experimental Biology, 9650 Rockville Pike, Bethesda, MD 20814.
- *The Harris Initiative for Quality Education; A Handbook for Action.* Harris Corporation, 1025 West NASA Boulevard, Melbourne, FL 32919.
- *Industry-Education-Labor Collaboration—An Action Guide for Collaborative Councils.* 1981. National Institute for Work and Learning, 1200 Eighteenth Street, N.W., Suite 316, Washington, D.C. 20036.
- *Science and Mathematics Education: A Guide for Chapters and Clubs.* Sigma XI, The Scientific Research Society, 345 Whitney Avenue, New Haven, CT 06511.
- *Partnerships in Science: Mini-Grant Programs.* 1986. The Triangle Coalition for Science and Technology Education, 1742 Connecticut Avenue, N.W., Washington, D.C. 20009.

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Appendix D

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as of March 17, 1986

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American Association for the Advancement of Science
American Association of Physics Teachers
American Astronomical Society
American Chemical Society
American Federation of Teachers
American Geological Institute
American Institute of Biological Sciences
American Institute of Physics
American Medical Association
American Nuclear Society
American Physical Society
American Society of Mechanical Engineers
AMOCO Corporation
Apple Computer, Inc.
Association for the Education of Teachers in Science
Chevron, U.S.A., Inc.
Council for Elementary Science International
Council of Chief State School Officers
Council of State Science Supervisors
Edison Electric Institute
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Exxon Research and Engineering Company
Federation of American Societies for Experimental Biology
Ford Motor Company Fund
General Electric Company
Hewlett-Packard Company
Institute of Electrical and Electronics Engineers, Inc.
International Business Machines Corporation
International Technology Education Association
Junior Engineering Technical Society, Inc.
Merck and Company, Inc.
National Association for Research in Science Teaching
National Association of Academies of Science
National Association of Biology Teachers
National Association of Geology Teachers
National Association of Teachers of Mathematics
National Education Association
National Institute for Work and Learning
National Science Supervisors Association
National Science Teachers Association
Native American Science Education Association
Science Service, Inc.
Technical Educational Research Centers

Appendix E

Excerpts from *Building Alliances for Science Education.* Manert H. Kennedy, Colorado Alliance for Science, University of Colorado, Boulder, Colorado, and Von Valletta, Minnesota Alliance for Science, Minneapolis, Minnesota; in *Science/Technology/Society,* NSTA Yearbook, 1985, pp. 252-261.

What Is an Alliance?

In Colorado and Minnesota a host of individuals and organizations have been at work for the last several years to build associations that have come to be called *alliances for science.* The Minnesota and Colorado experiences illustrate what these alliances are and what they can do, how alliances are built, how the roles of the partners in the alliance are determined, and how the alliance models can be applied to other states and regions. . . . This transcending of boundaries—across disciplines, across interest groups, and across institutions—is the primary goal of the Colorado and Minnesota alliances for science. Both alliances are consortia of organizations and individuals representing industry, business, schools, school districts, institutions of higher education, professional societies, government agencies, research laboratories, and community groups interested in the improvement of instruction in science, technology, mathematics, and related fields at all levels from K-12 through college.

The Colorado and Minnesota alliances attempt to achieve four major goals:

- Provide a forum for exchange of ideas and information on science education in the state;
- Serve as a setting for collaborative action on problems and priorities of statewide significance—activities which may require efforts and resources larger than those typically available to local schools and communities or to single institutions or agencies;
- Promote sharing, systematic use, and evaluation of existing resources (for example, speakers' bureaus, curriculum libraries and resource centers, industrial tours and field trips, consultants from industries and colleges, planetariums, and museums);
- Provide a mechanism for the formulation and implementation of solutions to these problems.

In Colorado and Minnesota, the alliances have provided the schools, institutions of higher education, and the private sector a means for the improvement of science and mathematics education that avoids duplication of effort, promotes uniformity and widespread participation, makes available resources beyond those of a single community or school district, and builds bridges between school and community. It provides opportunities for involvement of institutions like business and government research facilities, and provides continuity, so that plans for collaborative action can be carried out over periods of several years without being disrupted by changes in local personnel and budget allocations.

How Is an Alliance Built?

In Minnesota and Colorado the impetus for building alliances came from the major research universities in the two states. The Minnesota Alliance for Science, the first of its kind in the nation, was the brainchild of Roger Staehle, then dean of the Institute of Technology at the University of Minnesota in Minneapolis.

Staehle believed that the university should devote greater attention to improving precollege education in the sciences and related fields. University faculty had found themselves offering more and more remedial courses in mathematics; they also found that, despite the fact that Minnesota has the highest rate of graduation from high school in the country, many freshmen at the university lacked the background in science and mathematics necessary to successfully complete college-level work. Staehle, working with Edwin Stueben and Andrew Ahlgren, formulated plans for an alliance. After a year of effort, they succeeded in obtaining a grant from the Bush Foundation to establish the alliance office and systematize its work.

In Colorado the leadership came from Harrison Shull, chancellor of the University of Colorado-Boulder, and Richard Turner, dean of the School of Education. Shull and Turner were convinced that the university could do more to serve the elementary and secondary schools of the state. The university already had an impressive record of assisting science education. The university had in the 1960s and 1970s initiated several major curriculum reform efforts, including the High School Geography Project, the Biological Sciences Curriculum Study, and the Earth Sciences Curriculum Project. The university boasted faculty in several departments (including chemistry, physics, mathematics, geology, biology, and engineering) who had contributed to the work of the schools of the state.

Shull and Turner wanted to organize the resources of the university and develop closer contact between the university and the schools. Shull appointed a task force to study the situation. The product of these deliberations was the university's master plan for the improvement of K-12 science and mathematics education in the state of Colorado. That plan resulted in the establishment of new organizations and programs within the University, including the new alliance.

- The Colorado Alliance for Science brings related groups together for discussion of issues and collaborative action.
- The Science Interest Group stimulates public interest and support for science through planetarium shows, museum exhibits, science seminars for parents and children, and other events and services.
- The Scientists in the Schools program brings faculty from the academic departments to schools through such services as guest lectures, consultation on curricula, and equipment donation and repair.
- The Center for Education in Science, Technology, and Society develops new curricula, conducts educational research, and initiates teacher in-service training activities.

There is evidence that leadership and commitment on the part of a few individuals are the keys to successful formation of an alliance. There is no reason the leadership must come from a college or university, but building an alliance takes a great deal of work, and having access to the resources of a major university can expedite the process. In addition to leadership and resources, other variables are involved. For example, in both Minnesota and Colorado, directors have been retained on a full-time or nearly full-time basis to conduct the organizational work needed to establish the alliances.

In the early stages, development of both the Minnesota and Colorado alliances required a great deal of contact

with individuals, organizations, and institutions—the future partners of the alliance. A chronology of the organization of the Colorado Alliance for Science illustrates the activities that were undertaken in both states:

- *Spring 1982.* Harrison Shull, chancellor of the Boulder campus of the University of Colorado, appoints members to the University Task Force on Science Education.
- *September 1982.* Manert Kennedy and Faith Hickman, now directors of the Colorado Alliance for Science, approach the Colorado Science Supervisors Association for support of the alliance concept. The association forms an interim committee to assist University of Colorado faculty and staff in establishing the alliance.
- *January 1983.* The University Task Force and cooperating committees release a master plan that calls for the establishment of the alliance to form a link between institutions of higher education, schools, communities, businesses, and other interested groups.
- *June 1983.* The university commits funds for the support of the alliance for the 1983 fiscal year. The alliance becomes official at a planning meeting involving the Colorado Science Supervisors Association and the University Task Force.
- *August 1983.* The directors of the Colorado alliance visit their counterpart effort at the University of Minnesota. The name *Alliance for Science* is officially adopted with permission of the Minnesota alliance. Striking similarities between the two alliances in approach, purpose, and organization are noted.
- *September–November 1983.* The Colorado Alliance for Science hosts a series of planning meetings, each involving 25–40 representatives from business, industry, schools, research facilities, institutions of higher education, government agencies, professional societies, and community resource and interest groups. At each meeting, the concept of the alliance is reviewed and ideas for an Agenda for Collaborative Action are discussed.
- *December 1983.* The Colorado Alliance for Science hosts its first major conference, attended by approximately 160 people. The program features a supportive statement from the governor of Colorado and an address on national perspectives by F. James Rutherford, chief education officer of the American Association for the Advancement of Science and former assistant secretary of education. Work groups are formed and consensus papers for the Agenda for Collaborative Action are drafted.
- *February 1984.* The Steering Committee of the Colorado Alliance for Science is formed. The committee includes school superintendents, executive officers from business and industry, teachers, science supervisors, executive directors of nonprofit societies, directors of research laboratories, faculty from institutions of higher education throughout Colorado, leaders of minority groups, parents, and other individuals concerned with the improvement of science education.
- *May 1984.* The Steering Committee meets to review alliance activities and establish priorities for the Agenda for Collaborative Action.

The organization of an alliance should be flexible enough to take advantage of whatever opportunities may arise. In Colorado, for example, the alliance was asked by the Colorado Minority Engineering Association to assist with the modification of an existing metropolitan-area program for use in Colorado's rural, agrarian communities. The alliance accepted the invitation, and a series of Saturday seminars for minority students will begin in Alamosa, Trinidad, and Durango in the fall of 1984. Similarly, the Boulder-based Social Science Educa-

tion Consortium invited the alliance to cooperate in a cross-disciplinary curriculum development project designed to help teachers of the natural and social sciences stimulate interest in science among female students in grades 5-9. That invitation was also accepted, and plans are now under way for in-service programs around the state. In addition, an executive from Rockwell International approached the alliance with a proposal to organize a task force of retired scientists and engineers to assist the schools. The alliance's Steering Committee is sponsoring the effort, which is still in the developmental stages.

What Does an Alliance Do?

An alliance must operate under its own clearly-articulated agenda, yet remain responsive to unexpected opportunities. The process of exploring, clarifying, and prioritizing the agenda requires many months of work and input from hundreds of people. The varied points of view of the organizations and individuals must be considered, and needs determined, described, and assessed. Regrettably, it is impossible for such an organization to slay all dragons simultaneously; as a practical matter, certain areas of interest must be selected for attention.

In both Colorado and Minnesota, remarkably similar priorities emerged from the meetings of committees and work groups. These interest areas are:

- Stimulation of interest in science and science education among school administrators, business leaders, parents, students, and the general public;
- Initiation of mechanisms for change in public policies on science education;
- Improvements of support systems for science teachers; and

Major Activities of the Colorado Alliance for Science

Interest Area	Activities
Stimulate interest	1. Workshops for professionals from the media industry.
Change public policy	2. The Public Policy Work Group: addresses issues of public policy in science education, like graduation requirements, and recommends action. 3. The Organizational Work Group: determines steps needed to implement policy recommendations.
Improve support systems	4. Workshops for science teachers. 5. Principals' Leadership Conferences.
Improve learning resources	6. Adopt-a-School programs: encourage industry-school partnerships. 7. The Science-Math Clearinghouse: provides materials, speakers, and field trips. 8. Minorities in Science work group: provides outreach programs. 9. Local cross-district curriculum development assistance. 10. Cooperative planning for strengthening the bonds between schools and institutions of higher education.

- Improvements in the use of learning resources.

After these priorities were defined, alliance staff and members set about formulating plans for action in each of the four areas. The accompanying table summarizes major activities of the Colorado Alliance for Science that are now in a stage of planning or execution. Similar efforts are under way in Minnesota.

What is the Role of the Partners in an Alliance?

An alliance is a network of individuals and organizations. Hine described a network as "a badly knotted fishnet with a multitude of nodes or cells of varying sizes, each linked to all others either directly or indirectly," and asserted that networks emerge when people are trying to change society: "No matter what the 'cause,' the goals, or beliefs, and no matter what type of movement it is . . . whenever people organize themselves to change some aspect of society, a non-bureaucratic but very effective form of organizational structure emerges" (see Naisbitt, 1982, p. 196).

The Minnesota and Colorado alliances for science take advantage of the characteristics of networks by initiating collaborative actions that serve individual partners' interests. Industry, for example, wants to attract the finest scientists and engineers to work in their respective states, both known for the quality of their public education. Schools want to be able to show results of their labors—high student motivation and achievement—and they want the equipment, supplies, materials, training opportunities, facilities, and personnel required to accomplish these goals. Professional societies of the various disciplines want to attract superior scientists and science teachers to their ranks. Institutions of higher education want to attract top students in science and engineering fields and hope to raise their faculties and departments to positions of national eminence. Parents and community groups want the best possible schooling for their children. Businesses want entry-level employees who are educated in the fundamentals of science and possess skills of communication and capacity for continued learning. Government agencies and research laboratories want scientists of the highest caliber—individuals who can build the data bases needed to evaluate the technical dimensions of complex issues of public policy, including research and regulation. Teachers want to do their job well, provide the best possible instruction for their students in an environment also conducive to the teacher's own professional development. Each of these partners is at the center of the network—for all share the desire for the best possible science education for the youth of their state and of the nation.

The Colorado and Minnesota alliances for science each provide a mechanism through which individuals and members of organizations can act in their own interest while at the same time promoting the goals shared by the network's partners. Actions are multiplied in effectiveness, and ripples of influence are felt throughout the network's structure. For example, when the Hewlett-Packard plants in Colorado decided to create a Scientists in the Schools program at the University of Colorado, benefits were felt throughout the state. Some schools were direct recipients of Hewlett-Packard's services. Scientists were assigned to work side by side with teachers for 2 or 3 hours each week. The object of the collaboration was not specified; instead, each team identified its own needs and chose appropriate actions. In one school, a poorly organized science storeroom was completely revamped, cataloged, and made functional. In another the assigned scientist created new learning programs for students to use with the school's computers. In still another, the scientist designed

laboratory exercises using equipment that the school's faculty had access to but had not yet learned to use. In yet another school, the scientist and the teacher team taught units on recent topics in physics—units with materials that would never have been available without assistance from Hewlett-Packard's scientists.

Now other industries are examining the Hewlett-Packard model to initiate similar plans of their own. Elementary schools are now getting into the act, investigating the possible ways scientists might work in concert with primary and intermediate school teachers. The University of Colorado has provided publicity for the program, as well as evaluative services and support personnel. Newspaper accounts of Hewlett-Packard's efforts have stimulated increased public support for science education. Professional societies and teachers' organizations have asked Hewlett-Packard to provide in-service seminars for teachers on topics ranging from engineering in the precollege curriculum to management techniques for school personnel.

A new conception of the nature of education and the benefits to be derived from it is emerging from these activities. In the past, schools, industries, colleges, and universities functioned as independent entities. Any overlap was usually incidental and unplanned, and was rarely sustained. Today we see a growing realization that we are "smarter" when we work together. Schooling is no longer the exclusive domain of teachers and school administrators. Businesses and industries are no longer looked upon solely as sources of financial aid, but as partners in the educational enterprise. Institutions of higher education no longer function in isolation from their clientele. Instead, each entity is fit into the larger framework of learning, earning, and living. The question of the day is, "What should we do together?"

In an alliance, members contribute their own special resources and expertise. Industries and businesses provide personnel, knowledge, equipment, and financial support. Colleges and universities provide similar resources, and also expertise in curriculum development, education research, program evaluation, teacher education, and other kinds of professional training. Professional societies, research laboratories, and locally-based government agencies provide materials and knowledgeable specialists who contribute to all kinds of collaborative enterprises. Parents, community groups, school board members, and other individuals serve as advocates for improved science education and establish local support groups that make innovation possible. Teachers and students help establish an environment that promotes effective teaching and learning—a climate of exploration and action that reaches far beyond the classroom to the community at large.

Expanding the Alliance Model

Activities comparable to those of the Minnesota and Colorado alliances are under way in many states and are likely to spread to still more. The lessons that have been learned in Colorado and Minnesota will apply to most of these new groups. For example, in both states it has been necessary to respond to the requirements of the particular geography and demographics of the state. Colorado and Minnesota are large states; each has metropolitan areas in which the majority of the state's population resides, coupled with vast rural, agrarian areas. While an alliance is most likely to be initiated in an urban area, its activities should not be limited to the cities. It is important for the benefits to reach individuals from large and small communities. It is also essential that the needs of both urban and rural areas be differentiated and met through the collaborative actions of the alliance.

Assessment of the resource base is one of the most important considera-

tions. What industries operate in the areas to be served? What services are these industries able and willing to provide to schools? What curricular programs are now in use? What new curricula may be developed and shared by several districts? Where are the museums, planetariums, and engineering centers located? How can students and teachers be brought into closer contact with these facilities? What are the perceived needs of teachers for in-service training, and how can these needs best be met with existing state resources? Through what means can surplus equipment and supplies be shared with schools, and who will arrange and monitor donations and repairs? Where does the human expertise lie, and how can knowledgeable individuals be brought into contact with the schools that desire their consultative services? These and other questions are some of the major challenges that face the organizers and future members of the alliance.

Alliances must be sensitive to the politics of each community and the cultural norms and values that may operate in different locales. For example, Colorado's rural counties are home to large numbers of persons of Hispanic heritage. The cultural values of these people, along with the economic and social conditions present in these largely rural, agricultural communities, demand a different approach to science education from that typically applied in the suburban schools surrounding Denver. It is essential that an alliance develop good working relationships with leaders in each community and that local leaders retain the dominant voice in addressing the needs and interests of their constituencies. Furthermore, local strengths and weaknesses must be assessed on a case-by-case basis. In one area of Colorado, for example, the industrial base is minimal. The Bureau of Reclamation is active in the area, however, and is eager to provide guest speakers and field trips. Similarly, individuals from local businesses are enthusiastic and are working to show students the rewards of sound education in the sciences and mastery of the skills required for the success and expansion of these businesses.

In both Minnesota and Colorado the statewide alliances will in the long run make possible the establishment of local alliances for science. While a state alliance can undertake projects too ambitious for a single community to manage, and should continue to do so, the ultimate impact of any reform effort rests with the commitment of individuals at the local level. If the curriculum reform efforts of the 1960s taught us an important lesson, it is this: innovation cannot be sustained from the top down. Implementation occurs at the local level.

There are many needs to be met and problems to be solved. Statewide and local alliances for science together can initiate the collaboration that will make significant and lasting improvements in science education possible.

Appendix F

Questionnaire for Local Alliance Information

The Triangle Coalition for Science and Technology Education is collecting information on broad-based, local action groups (local alliances) that are supporting improvements in science and technology education.

The information will be compiled in a "clearinghouse," from which it will be available to all existing and embryonic local alliances.

If you are involved in a local alliance, either existing or embryonic, please send us information about it. You may copy this form and send your information on the copy. If you need more space, attach extra sheets.

LOCAL ALLIANCE INFORMATION

1. **Name of Organization** _____
   Contact Person (With Title) _____
   Address _____
   City, State, Zip Code _____
   Telephone Number with Area Code _____
2. **Purpose/Major Goals** _____
3. **Participating Organizations** _____
4. **Steering Committee (If you have one, please describe composition and functions.)** _____
5. **Target Population (Including Geographic Area)** _____
6. **Budget (1985 and 1986)** _____

7. Sources of Funds _____

8. Administration/Staff (Volunteer/Paid; Full/Part-Time) _____

9. Brief History (Including Source of Start-Up Funds) _____

10. Major Activities (Current, Completed, and Planned) (If you did a "needs assessment," please describe it.) _____

_____

Date Prepared

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